
Structural Engineering Report

on

East Boundary Wall at Sackville College



Structural Engineering Report

on

East Boundary Wall at Sackville College

For

Sackville College

Client: **Sackville College**
High Street, East Grinstead
RH19 3BX

Report author: **Andrew Turner**
BEng (Hons) CEng MIStructE
Conservation Accredited Engineer

Issuing date: **3 August 2023**

Document reference: 0180/REPORT 01

<i>Amendments:</i>	<i>Revision</i>	<i>Date</i>

Disclaimer

This report has been prepared by Andrew Turner Engineering Ltd using reasonable skill, care, and diligence for the Client in accordance with the agreed appointment, which sets out the limitations of the scope and services, and the approach to how this report was prepared. This report is confidential to the Client, and Andrew Turner Engineering Ltd accepts no responsibility of whatsoever nature of third parties to whom this report or any part thereof is made known. Any such parties rely upon this report at their own risk.

Contents

- 1.0 Introduction
 - 2.0 Description of the existing structure
 - 3.0 Observations on the condition of the existing structure
 - 4.0 Discussion and Recommendations
-

1.0 Introduction

This structural engineering report has been prepared for Rosalind Crowther, The Warden at Sackville College.

The purpose of the report is to provide conservation structural engineering advice on the condition of the eastern boundary wall which sits adjacent to College Lane and provide recommendations on how to proceed. The boundary wall has recently been identified in a Quinquennial Inspection as requiring urgent repair, given concerns that fragments of masonry could fall on to the highway. The location and extent of the wall inspected is shown in figure 1.1.

The observations and comments provided in this report are based on an inspection of the boundary wall on 26 July 2023. During the visit, a meeting was held with Alan Scrase, a tree surgeon, who advises the college on the condition of the trees on the college estate.

During the visit, the weather was mild with sunny intervals.

Observations made during the visit are based on a walk around the boundary wall from within the college grounds and from the highway, College Lane. No physical opening-up works, surveys, or investigations have been carried out and no samples of materials forming the structure have been taken or analysed.

By its nature, this report provides initial structural engineering advice on the condition of the boundary wall. It should therefore not be interpreted as a detailed building condition survey of the wall as a whole. The report only considers non-structural elements, fittings, and fixtures where they raise structural implications. It also does not consider every opened-up joint or crack in the fabric, as these are often non-structural in nature.

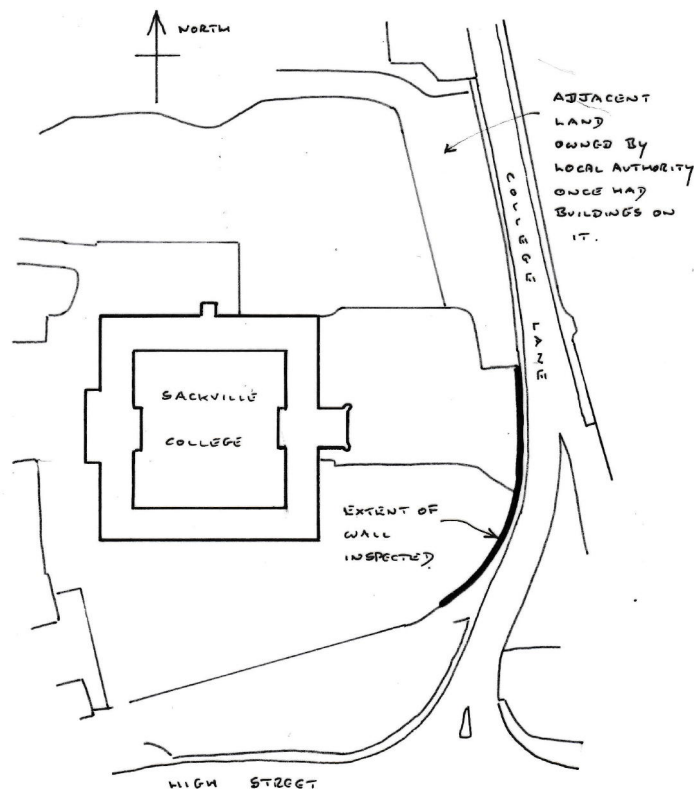


Figure 1.1:

Location and extent of wall
inspected in this report

2.0 Description of the existing structure

2.1 Site context

Location and Site Levels

The boundary wall forms part of the eastern boundary to the grounds of Sackville College, running for a length of about 48m adjacent to College Road.

Sackville College dates from the early 17th century is listed Grade I (list entry number 1248768). It is understood to have been completed as almshouses in 1619. The boundary wall is not mentioned in the listing description but is probably listed through association with the college building. The college and the boundary wall are also located within the East Grinstead Conservation Area.

According to detailed maps provided on the Historic England website, ground levels along College Lane by the boundary wall vary between 129.5m and 130.1m above Ordnance Datum (AOD), with the road gradually rising towards the road junction shared with the High Street and Lewes Road. The college grounds are raised between 1.6m and 4.0m above the highway, and the boundary wall therefore forms a line where there is a step change in ground levels.

There are numerous mature trees located on the college grounds close to the boundary wall, in addition to shrubs and other vegetation. Many of the trees in this group are reported by Alan Scrase to have Tree Preservation Orders on them.

The original date of the boundary wall is unclear. One of the earlier available historic Ordnance Survey maps that can be reviewed on-line formed a survey of 1870 and was published in 1872. This shows the boundary line broadly matches the existing alignment. It is conceivable that the boundary line existed since the college was established; this may have formed a naturally occurring feature in the landscape originally that was then later formalised during Georgian or early Victorian times.

The 1872 map also shows a line of narrow buildings on a plot of land immediately to the north of the wall. The subsequent historic maps suggest they were retained until the 1960's. Ground levels on this plot are similar to College Road and so the western and southern boundaries of this plot that are shared with the college grounds also step in level as a result.



Image 2.1:

Boundary wall from College Lane

Geology

The local geology map published by the British Geological Society (BGS) indicates the natural ground conditions on the site consist of the Ardingly Sandstone Member, which forms the Bedrock Geology on the site. Table 2.1 summarises the general descriptions for this stratum provided by the map.

Table 2.1: Summary of Geology (based on local geology map – BGS website)		
Geology layer	Stratum	Geology Map description
Bedrock geology	Ardingly Sandstone Member	Sedimentary bedrock formed between 139.4 and 133.9 million years ago during the Cretaceous period. Sandstone.

2.2 The boundary wall

The construction of the boundary wall varies along its length and consists of sections where the natural bedrock is exposed, sections of coursed stonework, and localised areas of brickwork. The variation in the detailing was probably determined by where the natural bedrock naturally occurs with the coursed stonework added later, to form a more formal boundary wall. The brickwork appears to be a more recent addition, representing more recent patch repairs that have been carried out.

Where the bedrock occurs on the face of the boundary, this may extend back some distance below the college grounds. Much of it probably forms a massive structure that naturally accommodates the change in ground levels.

As the profile of the bedrock is variable, the coursed stonework probably reflects a means of continuing the vertical face of the boundary line where the bedrock drops away. The coursed stonework therefore probably acts as a retaining wall to support the soil behind the stonework located above the bedrock. The thickness of this stonework is not clear.

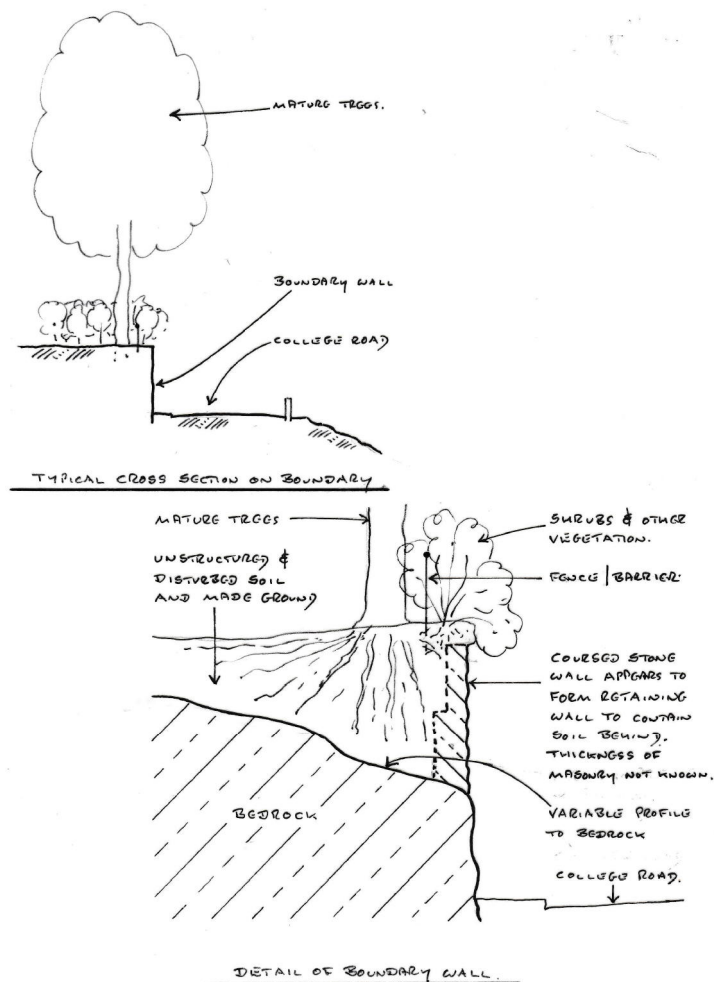


Figure 2.2:

Deduced view of cross section
through boundary wall: details
vary along length of wall

3.0 Observations on the condition of the existing structure

3.1 Introduction

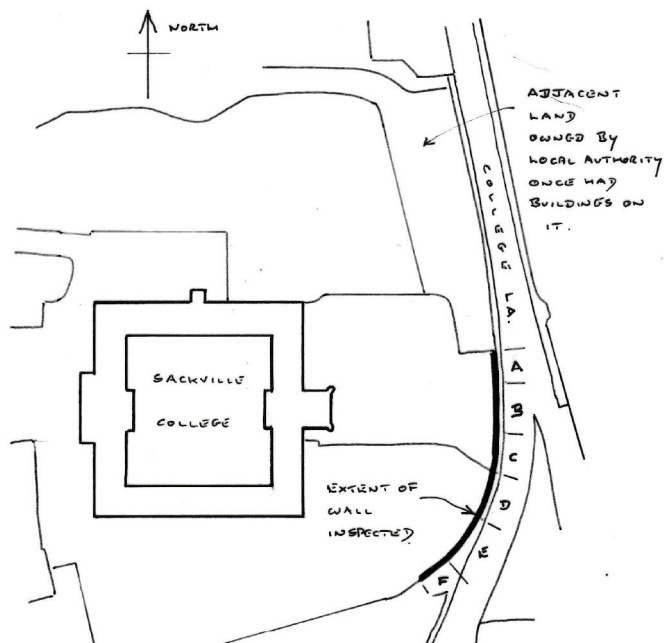
3.1.1 To assist with recording observations where viewed from the road, the wall face has been sub-divided in to six sections labelled A to F. These run from the north end of the wall towards the south.

The approximate positions of these sections is marked on figure 3.1.

Observations for these wall sections are set out in points 3.3 to 3.8 below.

Figure 3.1:

Subdivision of boundary wall (sections A to F) when viewed from the road



3.2 Observations from the top of the wall

3.2.1 The ground along the top of the wall forms an informal garden below the canopy of the trees. Shrubs predominate along the top edge of the wall outside the line of a metal fence.

By the boundary with the plot of land to the north, there is a wire fence (see image 3.2.1c). This is unlikely to act as an effective safety barrier to protect against someone falling from height.



Image 3.2.1a (right)



Image 3.2.1b



Image 3.2.1c

3.3 Section A of wall

3.3.1 Wall section:

Length c.5.5m

Height upto c.4.0m.

Wall faced with
coursed stonework.



Image 3.3.1

- 3.3.2 At low level, a stone block is missing from the face of the wall. This may have fallen out in the past.

Mortar repairs are visible above this area. It appears a hard cement-based mortar has been used.



Image 3.3.2

- 3.3.3 On the right hand side of the wall section, one stone block has a noticeable weathered front face, which is now set back from the general wall face.

Some stone blocks at low level also have weathered faces, although not as significant.



Image 3.3.3

- 3.3.4 Vegetation is growing across the wall, both at high level and across the righthand side. The vegetation at the top of the wall is dense, and some further mortar repairs are visible.



Image 3.3.4

3.4 Section B of wall

3.4.1 Wall section:

Length c.9.0m

Height c.3.2-3.5m.

Wall faced with bedrock and coursed stonework at high level, with localised sections of brickwork.



Image 3.4.1

- 3.4.2 At the junction of the bedrock, with the coursed stonework (of wall section A), there is a gap in the wall face. This provides a potential route for water ingress behind the wall face.

Some vegetation is growing on the wall at this interface. An root (possible dead) is visible in the central part of the wall section, by the righthand end of the brick panel.

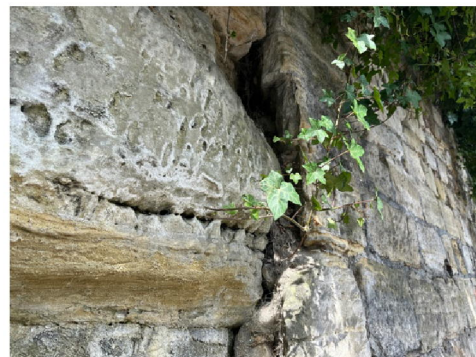


Image 3.4.2

- 3.4.3 A localised brick repair is located at high level within the middle part of this wall section. The lowest brick is not securely bonded to the wall face and does not have a robust support.

A rootball is visible above this area – possible associated with a holly bush.



Image 3.4.3a

On the lefthand side of this wall section at high level, one stone block is projecting from the wall face. The arrangement suggests stone blocks may have fallen away from below.

Dense vegetation and soil sit above and overhang the wall face. To the right of this area, a further stone block is rotating outwards very slightly. This may be linked with outward pressure from the roots of vegetation growing and expanding.



Image 3.4.3b

3.5 Section C of wall

3.5.1 Wall section:

Length c.8.0m

Height c.3.0-3.2m.

Wall faced with bedrock and coursed stonework, with localised sections of brickwork.

A small holly tree is located above the middle part of this wall section.



Image 3.5.1

- 3.5.2 A localised brick repair is located at high level on the righthand side of this wall section. The brickwork and the stonework above has distorted and is not securely supported.

Dense vegetation and soil sit above and overhang the wall face.



Image 3.5.2

- 3.5.3 A small holly bush is growing out of the wall towards the righthand side of this wall section. This has a noticeable root ball. The joints in the surrounding masonry have lost sections of mortar.

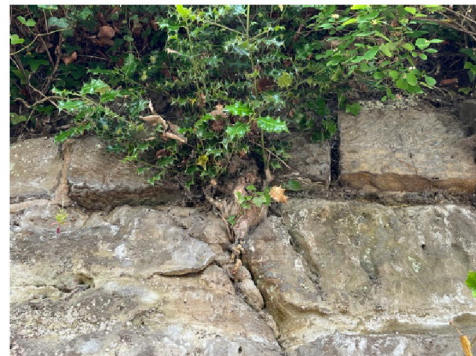


Image 3.5.3

- 3.5.4 Across much of the wall face, vegetation is growing. Some of this occurs at the junctions between the bedrock and coursed stonework.

The face of the coursed stonework towards the lefthand side of this wall section has a potential slight bulge. The joints between the stone blocks have lost sections of mortar.

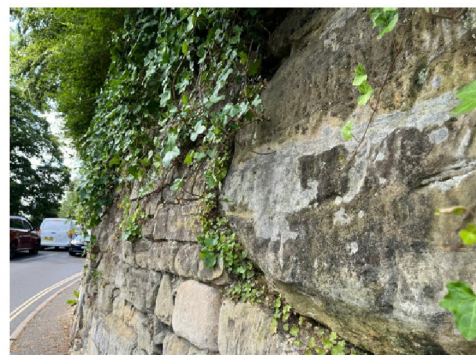


Image 3.5.4

3.6 Section D of wall

3.6.1 Wall section:

Length c.9.0m

Height c.3.2-2.5m.

Wall faced with bedrock and coursed stonework, with localised sections of brickwork.

A mature beech (?) tree sits above the righthand side of the wall.



Image 3.6.1

- 3.6.2 Within the section of brickwork within the middle of the wall section, some of the bricks appear to have been laid in a random pattern. Mortar is missing from around some of the bricks. The stonework above this area is also slightly distorted.

As with the other wall sections, dense vegetation and soil sit above and overhang the wall face.



Image 3.6.2

- 3.6.3 The face of the coursed stonework towards the righthand side of this wall section has a potential slight bulge. The joints between the stone blocks have lost sections of mortar. This area is located about 3-4m south of the bulging noted in section 3.5.4 above.

Ivy is growing across the face of the wall at high level.

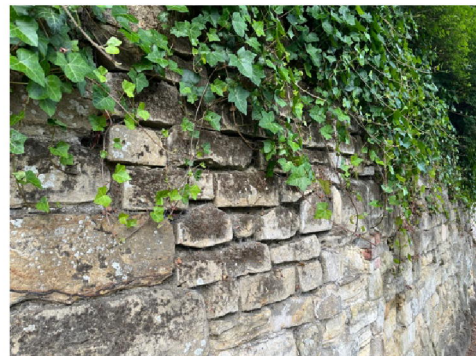


Image 3.6.3

- 3.6.4 Across sections of the wall face, vegetation is growing off the wall. This often occurs at the junctions between the bedrock and the coursed stonework, where gaps have opened up.

Some weathering of the face of the bedrock is visible at low level.



Image 3.6.4

3.7 Section E of wall

3.7.1 Wall section:

Length c.9.5m

Height c.2.7-2.5m.

Wall faced with bedrock and coursed stonework. Drainage pipes visible on lefthand side.

Three mature beech (?) trees sit above the wall section: two on the righthand side, and one on the lefthand side.



Image 3.7.1

3.7.2 As with the other wall sections, dense vegetation and soil sit above and overhang the wall face.

Within the middle section of the wall at high level, one stone block projects slightly. The joints in the stonework at high level are also open, suggesting mortar has fallen out.



Image 3.7.2

3.7.3 Ivy and other vegetation is growing across the face of the wall at high level.

Vegetation is also growing on the wall face. Often, this occurs at the junctions between the bedrock and the coursed stonework, where gaps have opened up.

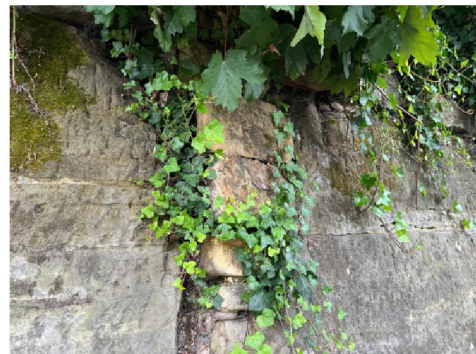


Image 3.7.3

3.8 Section F of wall

3.8.1 Wall section:

Length c.7.0m

Height c.2.5-1.6m.

Wall faced with
bedrock and coursed
stonework.

A mature beech (?)
tree sits above the
righthand side of the
wall.



Image 3.8.1

- 3.8.2 Within the middle portion of this wall section, the coursed stonework is bulging slightly and mortar from the joints has fallen out.



Image 3.8.2

- 3.8.3 Vegetation is growing across sections of the wall face. Some of this occurs at the junctions between the bedrock and the coursed stonework where gaps have opened up in the wall face.



Image 3.8.3

- 3.8.4 As with the other wall sections, dense vegetation and soil sit above and overhang the wall face.



Image 3.8.4

4.0 Discussion and recommendations

4.1 The condition of the boundary wall

The boundary wall is generally formed from a combination of bedrock and coursed stonework. Localised sections of brickwork appear to reflect later localised repairs to the face of the wall.

The issues that are affecting the condition of the wall structure are associated with the coursed stonework and brickwork and have been influenced by the vegetation and a lack of effective maintenance in recent years. Some repeating themes are:

- At high level along much of the wall, the vegetation and roots are densely packed, and this combined with the effects of root growth appear to be causing the top courses of stonework to become dislodged. This is also affecting some of the localised areas of brickwork.
- Slight bulging of the wall face may have occurred at locations along the wall face.
- At lower levels, vegetation is growing on the wall face and at the junctions between where the face of the bedrock meets the coursed stonework.
- Mortar has fallen out of many mortar joints and other mortar joints have been previously repaired using a hard cementitious mortar. Gaps occur at the junctions between the natural bedrock and the coursed stonework.

Roots from vegetation can penetrate small crevices and loosen the mortar in masonry. Such action can open pathways for moisture into the heart of the wall. Water ingress encourages fine material to be washed out of the mortar and over time this can loosen the stonework further. Freeze-thaw action can exacerbate the situation. Where hard cementitious mortars have been used, this can encourage further problems as water can get trapped and cause an increase in hydrostatic pressure within the depth of the wall. Where substantial shrubs and trees grow behind a retaining wall, root growth can also exert pressure on the rear face of the wall.

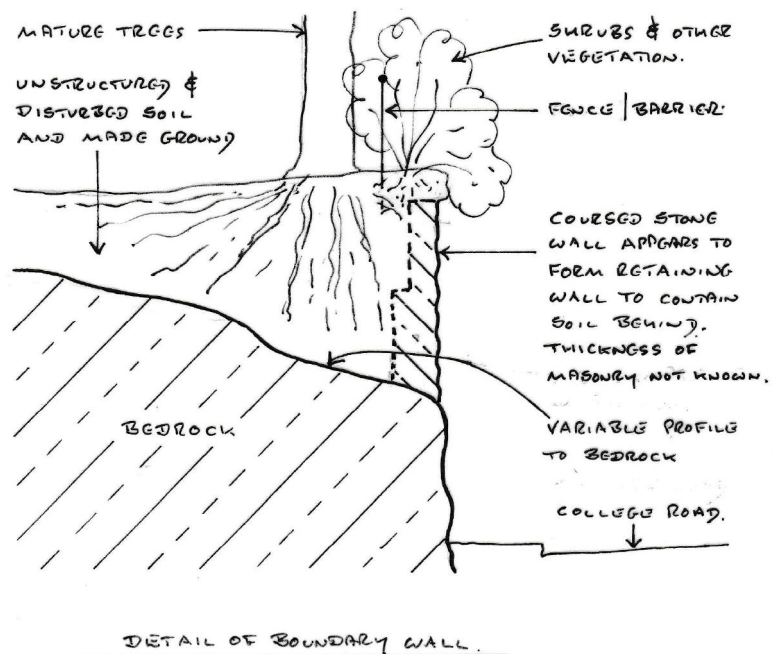


Figure 4.1:
Deduced view of cross
section through
boundary wall: details
vary along length of wall

These mechanisms can lead quickly to a deterioration in the condition of the masonry. This process often accelerates over time, commencing with a loss of mortar and localised bulging, as roots systems grow and induce pressure on the wall, both within the wall structure and from behind the wall. With time, it can lead to localised collapses, where individual pieces of masonry fall out of the wall, and later, more significant collapses.

As such, the challenges involved in repairing the wall become greater over time, but given the adjacent highway and pavement, the deteriorating condition of the wall also raises potential health and safety concerns.

4.2 Areas of structural concern

In summary, whilst many sections of the wall appear to be in an average condition for their age and type, some sections are in a poorer condition. These cover the apparent bulging in the wall, as discussed in sections 3.5.4, 3.6.3, and 3.8.2, and the distorted shaped and projecting stonework across the top stone course across much of the length of the wall.

In addition, there are a few isolated examples which are also considered potential health and safety concerns. These are the fragile brickwork noted in image 3.4.3a, the projecting stone block noted in image 3.4.3b, the distorted brickwork noted in image 3.5.2, and the slightly projecting stone block in image 3.7.2. These areas are illustrated again in images 4.2 to 4.5 below.

If vegetation is allowed to continue to grow as it has done recently, and the wall is left untouched, other sections of the boundary wall could quickly deteriorate. Urgent action is therefore recommended to address these issues.

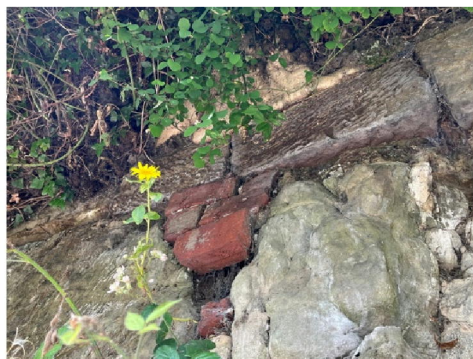


Image 4.2: wall section B



Image 4.3: wall section B



Image 4.4: wall section C



Image 4.5: wall section E

4.3 Recommended strategy

In developing a repair strategy for the boundary wall, a longer-term plan for how the vegetation adjacent to the boundary wall should also be considered as it is so influential on how the condition of the wall is maintained. Simply managing the vegetation by cutting it back from time to time will not effectively remove many of the issues affecting the masonry and such an approach could only practically be done from the highway side, which would involve temporary road closures.

It is therefore recommended that a landscaping plan is developed that significantly reduces the extent of shrubs and bushes on top of the wall, and which reduces ground levels slightly so that the ground immediately adjacent to the back face of the wall is at a slightly reduced level to the top of the masonry. Once this is done, regular annual maintenance to remove new growth could be carried out from the top of the wall. Such an approach would also provide a far better environment for the boundary wall as it would help limit the potential for new root growth affecting the masonry structure.

Much of this work is needed in any case to effectively repair the top sections of the masonry wall, where much of the movement and damage has occurred. By clearing the vegetation, and then lifting many of the distorted stone blocks, many of the embedded roots can be effectively removed. This clearance work would also allow some trial investigations down the back face of the wall to be carried out, to establish more clearly the full width of the coursed stonework, and to establish whether tree roots are contributing to the bulging that is visible in the wall.

Based on the observations carried out to date, the following anticipated repairs are required to the boundary wall once ground levels have been reduced at the top of the wall and the vegetation has been cleared, both from on top of the wall and from the wall face:

- i. Allow for rebuilding the top stone course along the length of the wall. At some locations, the rebuilding work may need to extend down a further stone course or two to remove roots at a lower level or to resupport sections of masonry which are currently projecting from the face of the wall.
- ii. Allowance should be made for locally rebuilding the bulged sections of the wall, as noted in sections 3.5.4, 3.6.3, and 3.8.2. A mature tree sits close to the apparent bulging noted in section 3.6.3 and so the rebuilding works here needs to consider how the stability of the tree is maintained. The rebuilt sections can reuse the stone removed from the wall and be laid in a low-strength lime mortar. Drainage pipes can be introduced through the rebuilt wall face to help drain water from behind the wall face.
- iii. Where practical, remove hard cementitious mortar from the face of the wall and make good using a low-strength lime mortar.
- iv. Localised sections of brickwork can be retained where the condition of the brickwork is reasonable, but otherwise potentially unstable brickwork should be removed and replaced with local natural stone.
- v. Remove all loose mortar and make good joints across coursed stonework using a low-strength lime mortar.

- vi. As the stability of the coursed stonework on the north corner of wall section A appears to rely partly on the return wall that runs back along the edge of the plot of land to the north, repairs to this return wall should be carried out too. The vegetation hiding this wall face prevents the condition of this wall being established at this time but repairs similar to those highlighted above are anticipated. The wire fence on top of this section of wall should be addressed too, to provide a more effective safety barrier.

Once the vegetation has been cleared and ground levels reduced, other issues may arise that also need attention. As such, a contingency sum should be set aside for dealing with surprises as the works proceed. Such risks could be managed by phasing the works so that the first phase of repairs can inform the scope of repairs and cost budgets for later phases of work.

Much of this work can be managed and specified by an architect with experience of dealing with historic masonry walls. It would be prudent for an engineer to specify and inspect the trial pit investigations to assess whether the wall structure requires more substantial repairs, particularly where apparent bulges have occurred.

These repair works and the landscaping works to clear the vegetation and reduce ground levels will require a partial road closure to provide high level and safe access. Given the potential listed status of the wall and it sits within a conservation area, these works are likely to require listed building consent.

If time is required to help fund and plan these works in greater detail, the items identified as potential health and safety concerns should not be delayed and addressed promptly. A mason should check the areas of concern. Possible emergency repairs could include the introduction of additional mortar to secure bricks that potentially lack support, adding temporary timber props below projecting stone blocks, or removing the brick or stone block causing the concern, if practical to do so. It would be prudent to discuss these urgent works with the conservation officer to understand what forms of approval will be necessary.

Once these repairs have been completed, it would be prudent for the wall to be inspected on an annual basis and any new vegetation removed before it becomes more significant. Much of this could be done from the pavement. In addition, the wall should continue to be inspected as part of the regular Quinquennial inspections so that its condition can continue to be regularly monitored.

Andrew Turner Engineering

CONSERVATION ACCREDITED ENGINEER STRUCTURAL ENGINEERING CONSULTANCY

Conservation Engineering

Structural Appraisal & Design

Expert Advice

Research & Development

W: andrewturnerengineering.com

